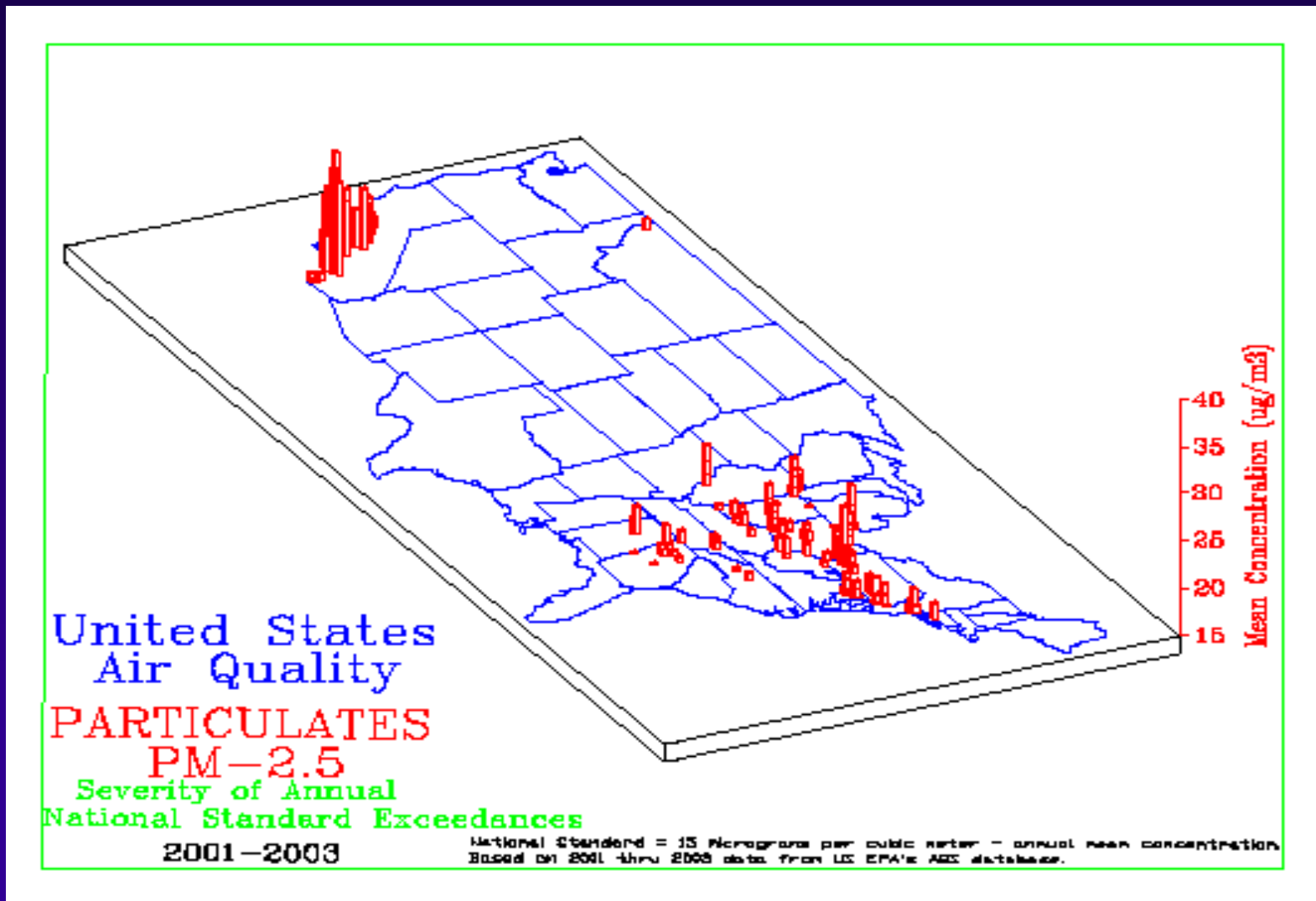




No Particle Left Behind

Michael Lipsett, M.D.
Oakland, CA

PM2.5 Annual Averages Above NAAQS

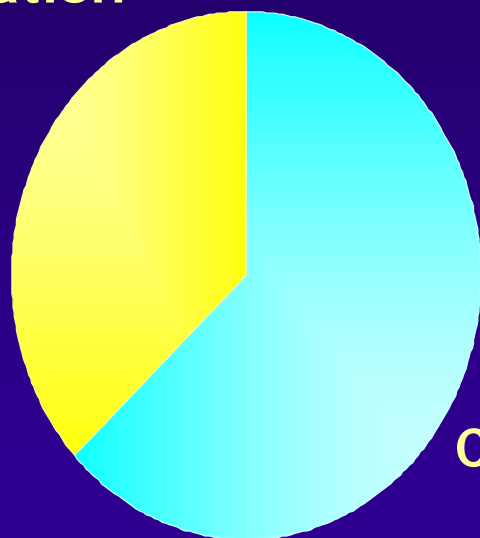


(Source: U.S. EPA, Review of the National Ambient Air Quality Standards for Particulate Matter)

California Accounts for Majority of National PM Exposures

Annual PM_{2.5}
(3-year mean)

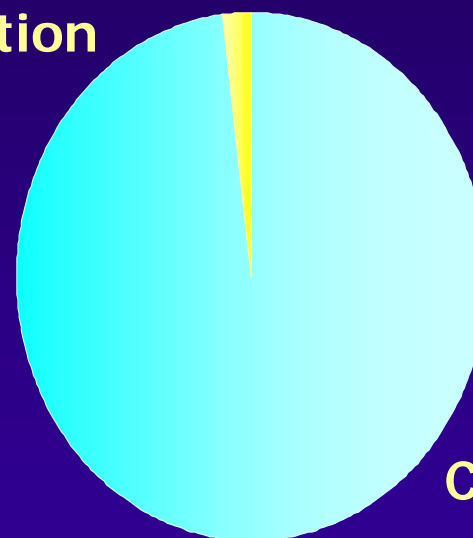
Rest of Nation
37%



California
63%

24-Hour PM_{2.5}
(3-year mean 98th percentile)

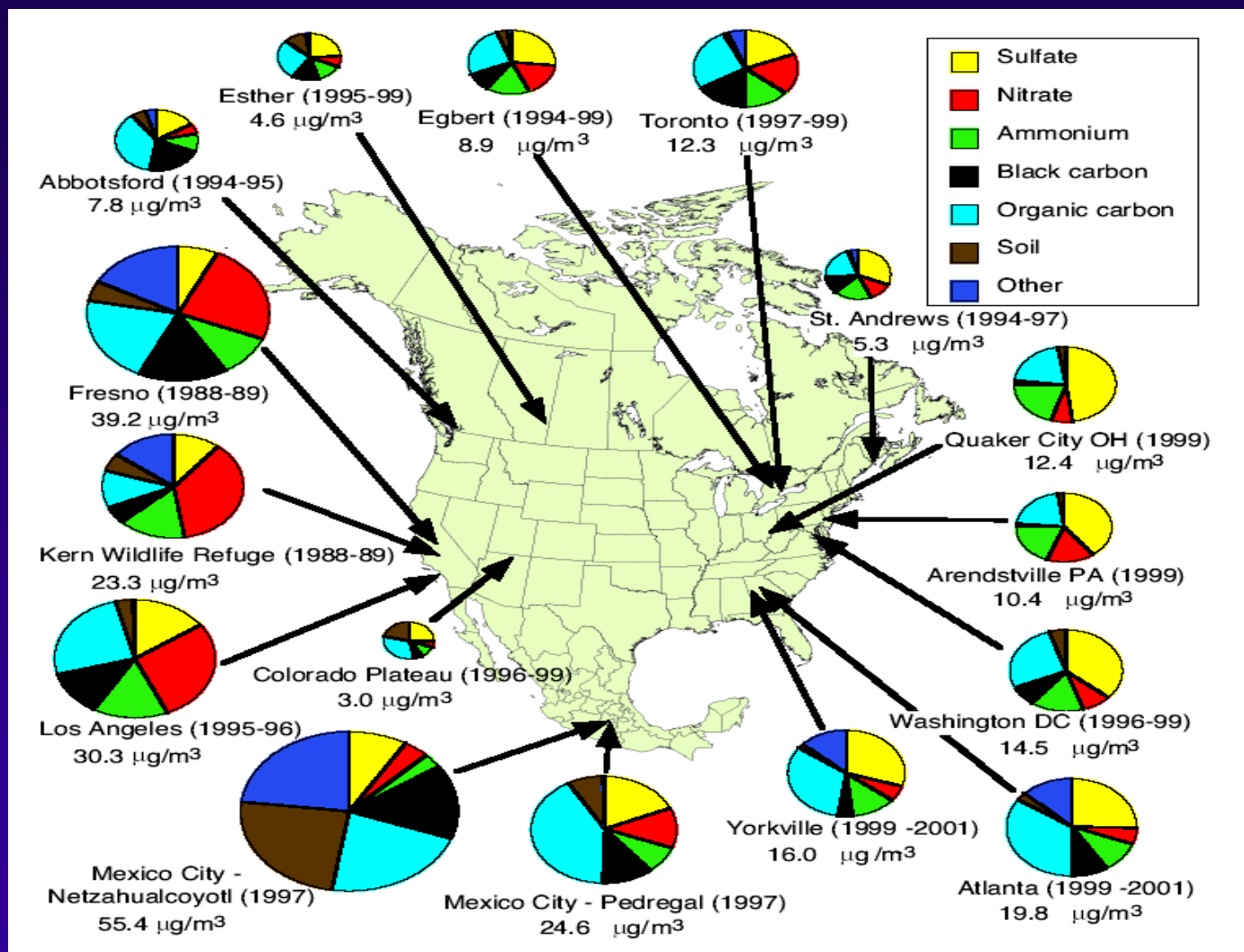
Rest of Nation
2%



California
98%

Population-weighted exposures above NAAQS, based on 2000-02 AIRS data (*Source: California Air Resources Board, Planning and Technical Support Division*)

California PM2.5 Mostly Nitrate and Carbon, Very Little Sulfate

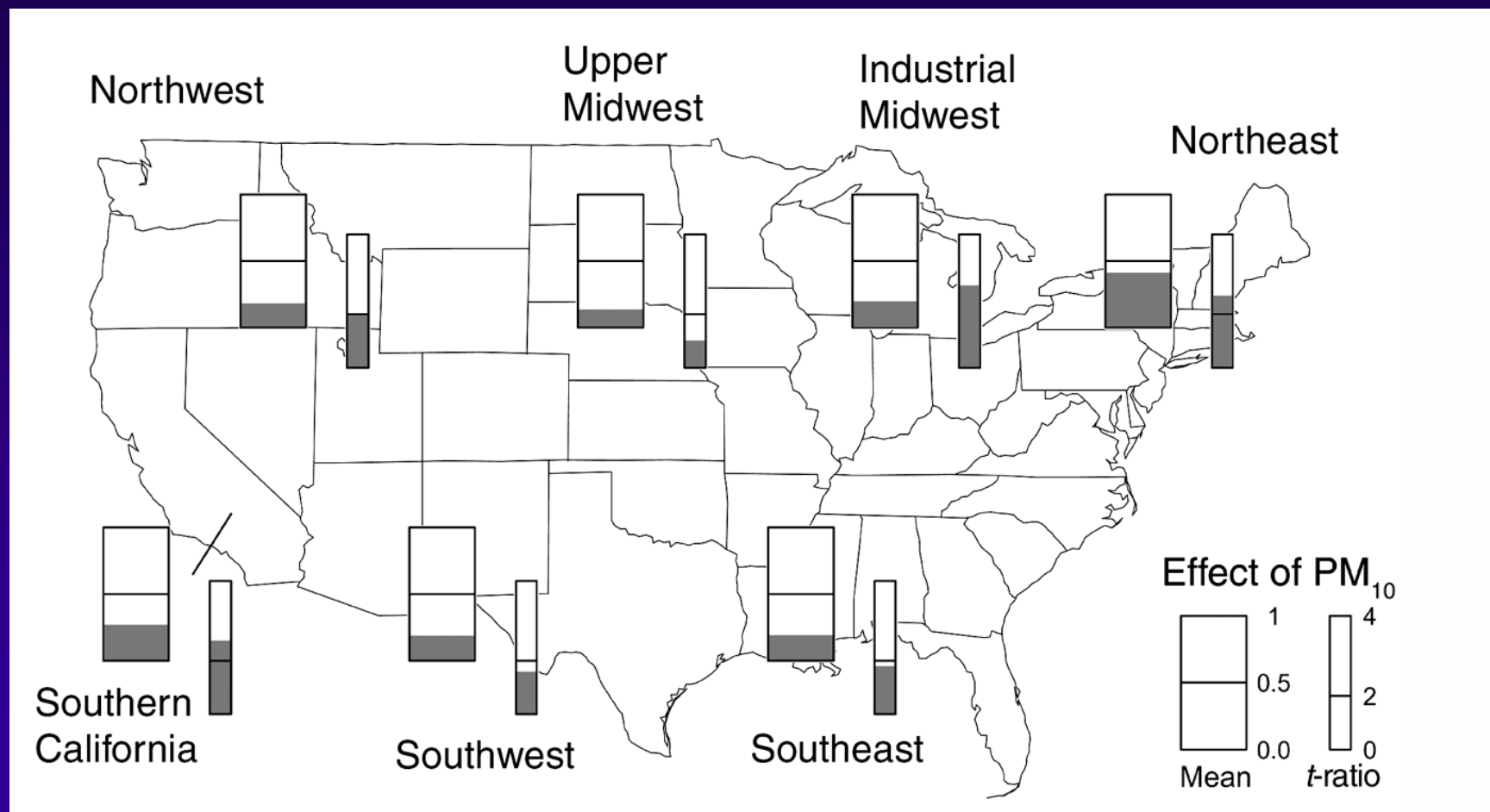


(Source: Particulate Matter Science for Policy Makers:
A NARSTO Assessment, February 2003)

Initial recommendations

- Toxicology database on nitrate salts is quite limited; generally not suggestive of significant toxicity from brief exposures
- Recommend more compromised animal research, joint exposures, examination of cardiopulmonary endpoints (e.g. heart rate variability)
- Should include as explanatory variable in epidemiological research as well (*cf. Fairley, Environ Health Perspect 1999;107:637-641*)

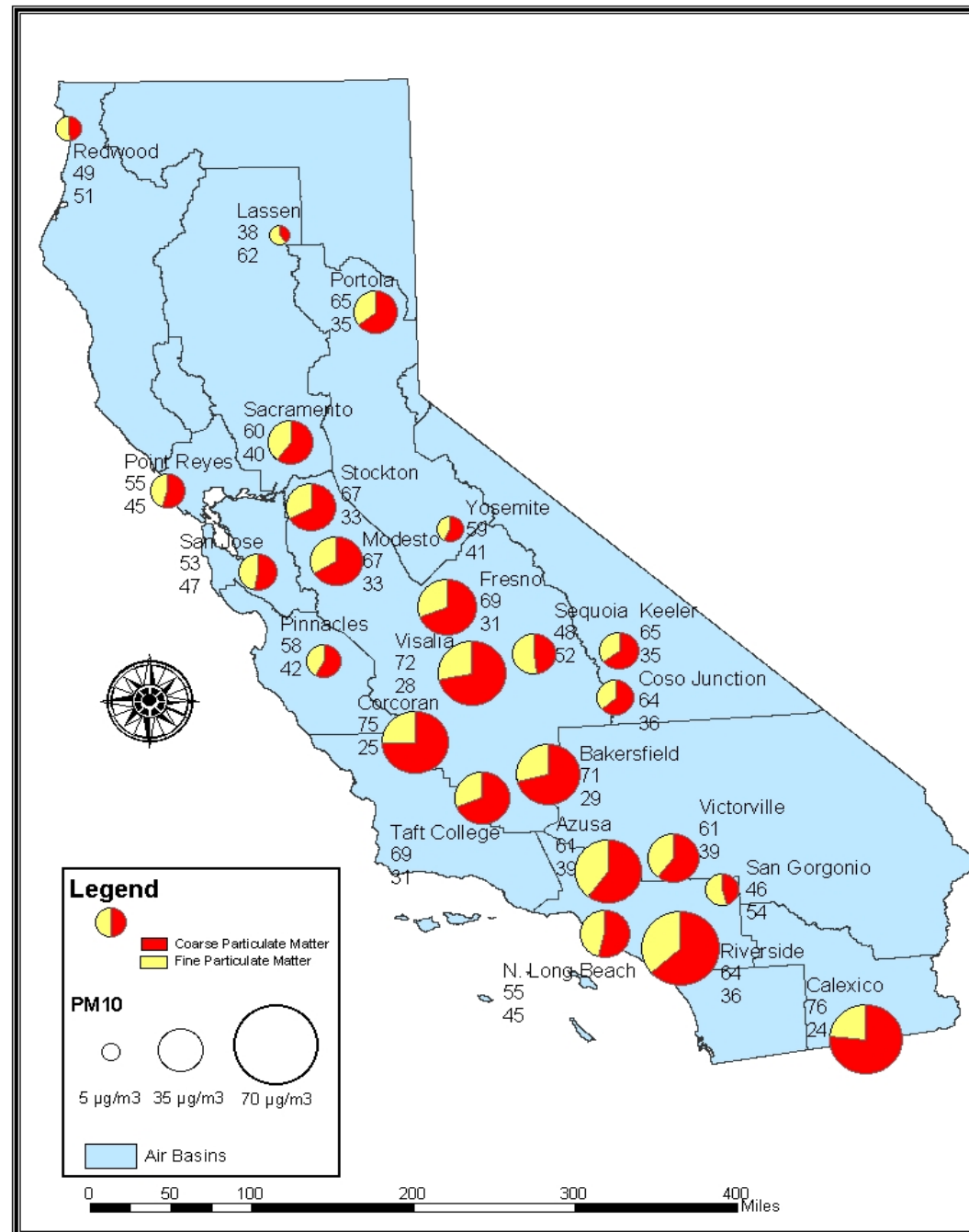
Strongest PM₁₀-Mortality Associations in Northeast and Southern California



(Source: HEI Special Report *Revised Analyses of Time-Series Studies of Air Pollution and Health*, May 2003).

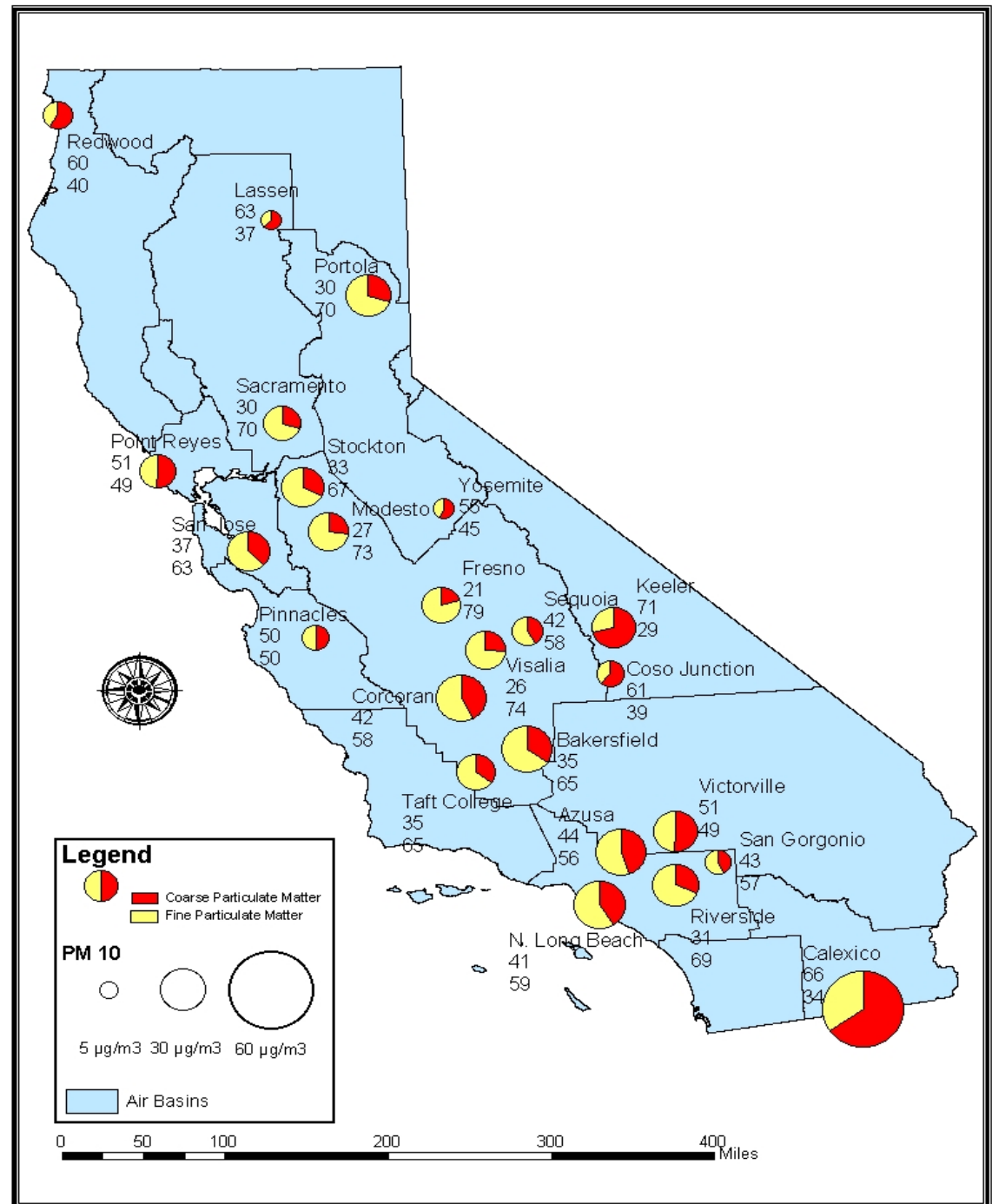
Average fine and coarse PM data for summer 1996-1999

(Source: Motallebi N, Taylor CA Jr., and Croes BE. J. Air Waste Manage. Assoc 2003; 53: 1517-1530)



Average PM fine and coarse PM data for winter 1996-1999

(Source: Motallebi N, Taylor Jr. CA, and Croes BE. *J. Air Waste Manage. Assoc.* 2003;53: 1517-1530)



Toxicological Studies of With Greater Effects of Coarse than Fine PM

- *In vitro* cell injury and cytokine production (*Pozzi et al. Toxicology 2003*)
- Oxidative DNA damage *in vitro* (*Greenwell et al. 2002*)
- Inflammatory cytokine production, phagocytosis and other functional changes in alveolar macrophages, related to endotoxin content (*Becker et al. Exp Lung Res 2003*)
- Reduced alveolar macrophage function, not related to endotoxin (*Kleinman et al. Toxicol Lett 2003*)

Epidemiological Studies of Daily Mortality

- **PM2.5 more important than coarse**
 - Santa Clara, CA (*Fairley et al. 1999*)
 - Harvard six cities (*Schwartz et al. 1996*)
- **Coarse more important than fine**
 - Mexico City (*Castillejos et al. 2000*)
 - Coachella Valley, CA (*Ostro et al. 2000*)
- **Coarse \approx fine**
 - Santiago, Chile (*Cifuentes et al. 2000*)
 - 8 Canadian cities (*Burnett et al. 2000*)

Epidemiological Studies of Asthma

- **PM2.5 more important than coarse**
 - Reanalysis of 6 cities, Uniontown and State College, PA (symptoms) (*Schwartz J et al. 2000*)
- **Coarse more important than fine**
 - Toronto (hospitalizations) (*Lin M et al. 2002*)
- **Coarse \approx fine**
 - Seattle (hospitalizations) (*Sheppard L et al. 1999*)

Coarse Particles: Recommendations

- Coarse fraction predominates in much of the West, but research database is sparse
- Recommend:
 - Epidemiological studies involving direct measurement of coarse fraction, rather than PM₁₀-PM_{2.5}
 - More toxicological evaluations of the coarse fraction from multiple locations, including cardiovascular and respiratory endpoints



